SCIENCE AND ART DEPARTMENT
OF THE COMMITTEE OF COUNCIL ON EDUCATION.

BETHNAL GREEN BRANCH OF THE SOUTH KENSINGTON MUSEUM.

A BRIEF GUIDE

TO THE

ANIMAL PRODUCTS COLLECTION.

(FIRST ISSUE.)

LONDON:
PRINTED BY GEORGE E. EYRE AND WILLIAM SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.
FOR HER MAJESTY'S STATIONERY OFFICE.
1872.

Price One Penny.

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THE BETHNAL GREEN BRANCH OF THE SOUTH KENSINGTON MUSEUM.

UNDER THE DIRECTION OF THE LORDS OF THE COMMITTEE OF COUNCIL ON EDUCATION.

LORD PRESIDENT, THE MARQUESS OF RIPON, K.G.
VICE-PRESIDENT, THE RIGHT HON. W. E. FORSTER, M.P.

I. In tracing the origin of the Branch Museum of Science and Art at Bethnal Green it will be necessary to refer, though briefly, to the early days of the parent institution, at South Kensington, from whence a considerable portion of the new edifice and of its contents have been derived.

II. The South Kensington Museum stands on 12 acres of land, acquired by the Government at a cost of 60,000*l.*, being a portion of the estate purchased by Her Majesty's Commissioners for the Exhibition of 1851 out of the surplus proceeds of that undertaking.

III. Here, in 1855, a spacious building was constructed, chiefly of iron and wood, under the superintendence of the late Sir William Cubitt, C.E., at a cost of 15,000*l.*, intended to receive several miscellaneous collections of a scientific character mainly acquired from the Exhibition of 1851, and which had been temporarily housed in various places.

IV. In addition to the collections already alluded to, the whole of the Fine Art collections which had been exhibited at Marlborough House since 1852 was also removed thither, and this was supplemented by numerous and valuable loans by Her Majesty the Queen and others.

V. This building was opened on June 22nd, 1857, as THE SOUTH KENSINGTON MUSEUM. Although in many respects well suited to its purpose, this iron building was avowedly of a temporary character, and from the first it was intended to replace it by buildings of a more architectural character and of more substantial materials. The erection of these permanent buildings was commenced at once, and at the beginning of the year 1865 sufficient progress had been made to render the removal of the iron building necessary.

VI. It appeared to the Lords of the Committee of Council on Education that "this iron building might usefully be divided " into three portions, and that one of these portions might be " offered to the proper authorities in the north, east, and south " of London respectively, at a nominal sum, in order to assist " in the formation of district museums, security being required " for the completion of each portion in a suitable manner, and " for its permanent appropriation to public uses." After some correspondence with other Departments of the Government, it was decided that measures should be taken for carrying out this proposal.

VII. On May 6, 1865, a meeting of noblemen and gentlemen interested in the establishment of Suburban or Metropolitan District Museums was held at the South Kensington Museum, the Lord President of the Council, Earl Granville, being in the chair, at which the proposal was fully discussed, and a strong desire was expressed by the representatives of the various suburban districts of the north, east, and south of London to secure a share of this building, the great difficulty felt in each case being the providing of a suitable site. It was decided that after a period of six months each district should be at liberty to put in its claim to a portion of the iron building, and send its application to the Science and Art Department.

VIII. On March 7th in the following year (1866) Mr. now Sir Antonio Brady addressed the following letter to the Lord President of the Council:

Stratford, E., 7 March 1866.

May it please your Lordship,

When I and others acting with me had the honour of attending the meeting held under your Lordship's presidency, in the Lecture Room of South Kensington Museum, on the 6th May last, on the subject of Local Metropolitan Museums, I put in a plea on behalf of the million artisans inhabiting the densely populated manufacturing and labouring districts in the East of London; and I pointed to a site most admirably placed in the very centre of the East-end, which I then hoped might be made available for the proposed museum.

The land in question, containing about 4½ acres, is close to Mile-end Station, one mile from Shoreditch on the Great Eastern Railway; it is near the junction of the Hackney and Cambridge Heath Roads, and is the centre of a network of railways, and omnibuses run in all directions, at twopenny and threepenny fares to and from all parts of London.

The site is about one mile and three quarters from the Bank of England, and two miles from the General Post Office, and taking the proposed site as a centre, within a radius of two miles are comprised a

large portion of the following extensive districts, viz.: City of London, Shoreditch, Finsbury, St. Luke's, Old Street, Hoxton, Islington, De Beauvoir Town, Canonbury, Ball's Pond, Kingsland, Dalston, Clapton, Homerton, Hackney, Victoria Park, Old Ford, Bow, Stepney, Limehouse, Poplar (including West India Docks), parts of Rotherhithe and Bermondsey (including Surrey and Commercial Docks), Shadwell, Wapping, St. George's-in-the-East (including London and St. Katharine's Docks), Tower, Whitechapel, and Mile-end.

This circle of two miles radius embraces the N.E. and E. postal districts, part of the N. district, and parts of the E.C. and S.E. districts.

The land in question was bought as a gift to the poor in King James's reign, when this part of London was open fields, and the trustees, with the consent of the Charity Commissioners, have unanimously agreed to sell the land for the purposes of the proposed museum, and to invest the purchase-money, which has been conditionally offered and excepted.

I have now the pleasure of informing your Lordship that, if this site is acceptable to the Government, I am authorised, on the part of the committee acting with me, to guarantee to raise the purchase money necessary to acquire the fee simple, and to offer this magnificent site to the Government for the purpose of erecting thereon a museum for the East-end of London.

The site is marked red in the accompanying maps, and is more particularly described in the plan hereunto annexed; it will be seen that it occupies a most commanding position. There is no other suitable spot unbuilt on, but if we had the choice of any ground in the East-end we should recommend the position of this site in preference to any other.

It is not my purpose to enter on the advantages of local museums. After what passed at the meeting at South Kensington, the value of institutions such as we wish to see established in the East-end is admitted on all hands; but what I desire respectfully to submit to your Lordship is the kind of museum which those acting with me would wish to see erected.

During the past year the subject of local museums has been much ventilated, and as the time has now arrived when it seems a necessity to provide more room for the great national collections, we respectfully submit that it is a good and fitting opportunity to make the national collections more useful and more accessible than they now are, and I trust this splendid site may induce the Government to entertain the propositions I have the honour to submit for their consideration.

1st. From inquiries made since the meeting last May, it is found that it will be utterly and entirely impracticable for a permanent building to be erected by local efforts, or to maintain the necessary staff if a building were otherwise provided; and we feel that this could only efficiently be done by the Government as a part of one comprehensive scheme. We find it will require all our efforts to raise the funds to pay for the site, and under these circumstances we humbly submit to your Lordship

that the Government should, in exchange for the site, take the whole matter into their own hands as a national affair.

2ndly. The scheme that commends itself most to our minds is, not to distribute the superfluities of the British Museum *piecemeal* amongst several local museums, but that typical collections illustrating one branch of science should be arranged in one of several museums in different quarters of the metropolis. The British Museum would thus be relieved of its plethora without impairing the value of any one collection; for instance, the natural history collections may be kept together in one place, the ethnological in another, so that anyone requiring to study any particular branch would know to what museum to resort.

In any plan of a museum that may be adopted for the improvement of the working classes, we submit that if they are to benefit by it to the fullest extent, it must be placed in a neighbourhood accessible to them, and must be open of an evening. We submit that it be made *educational in the widest sense of the word*, and that convenient and comfortable refreshment-rooms be added to the other attractions of the place.

I am to request that your Lordship will be pleased to communicate your wishes in this matter, that we, on our part, may at once take the necessary means to give legal effect to this arrangement, if concurred in by your Lordship.

The land being unoccupied would be available immediately the preliminary agreements were finally settled.

I have, &c.

(Signed) ANTONIO BRADY, J.P.,
Honorary Secretary.

To the Right Honourable
Earl Granville, K.G., Lord President
of Her Majesty's
Most Honourable Privy Council.

IX. This letter was at once taken into favourable consideration by the Lords of the Committee of Council on Education, Earl Granville and Mr. Bruce being respectively President and Vice-President. A change of Government shortly afterwards took place, which caused some delay, but on December 6, 1866, the Duke of Buckingham being President and Mr. Corry Vice-President, a minute was passed recommending the proposal to the favourable consideration of the Lords Commissioners of Her Majesty's Treasury, and asking that an estimate of the probable cost might be included in the votes of the ensuing year. The following paragraph occurs in this minute :—

"My Lords regret that Mr. Brady's offer on behalf of Bethnal Green can be adduced as the sole proof of the practical earnestness of the several districts of the metropolis to act in establishing district museums. Their Lordships, therefore, propose

that the iron columns, flooring, stairs, window fittings, heating arrangements, &c. of the whole of the iron building should be re-erected as soon as practicable at Bethnal Green, on the free site provided by the locality, but that brick walls and a slate roof should be used instead of iron; and they estimate that the cost will be 20,000*l.* The works would thus be of a permanent nature."

X. The Treasury (the Right Hon. B. Disraeli being then Chancellor of the Exchequer) accepted the proposal to re-erect the structure and to provide for its maintenance, and a vote of 5,000*l.* on account was granted by the House of Commons towards the cost of removal and re-erection of the building, but some delay arose in consequence of legal difficulties as to the conveyance of the ground. By the untiring efforts of Sir Antonio Brady, the Rev. Septimus Hansard, rector of Bethnal Green, Mr. J. M. Clabon, Dr. J. Millar and others, heartily seconded by the trustees of the land and supported by the Government, these difficulties were at length surmounted, a special Act of Parliament having been obtained for the purpose (31 Vict. c. 8.); and on 13 February 1869, the four gentlemen above named, acting on behalf of the subscribers to the fund for the purchase of the site, attended at the Council Chamber, Downing Street, and presented to the Lord President and Vice-President of the Committee of Council on Education the title-deeds of the site.*

XI. After the removal of the materials had taken place the erection of the building was at once commenced in accordance with plans prepared for the Department of Science and Art under the direction of Major-General Scott, C.B.

XII. At the beginning of the present year (1872) the building was sufficiently advanced for the reception of objects. Two important collections, formerly exhibited in the iron buildings, already existed in the South Kensington Museum ready for transfer to Bethnal Green, the ANIMAL PRODUCTS COLLECTION, intended to illustrate the various applications of animal substances to industrial purposes; and the FOOD COLLECTION, one of the most popular divisions of the Museum. These, with an important series of examples of Economic Entomology recently formed by Mr. Andrew Murray, now occupy the whole of the space on the ground floor under the galleries, and it is confidently

* The whole of the official correspondence on the subject of the establishment of this Branch Museum has been printed as a Parliamentary Paper, No. 218, session of 1872.

believed that they will prove of great and abiding interest and educational value, forming as they do no inconsiderable contribution towards the establishment of a complete trade museum, the necessity for which at the East-end of the metropolis has long been recognised.

XIII. The galleries of the building on the first floor are at present assigned to Paintings and other Fine Art objects, and the Lords of the Committee of Council on Education are indebted to the generous liberality of Sir Richard Wallace, Bart., for the loan of a collection of Art Treasures of almost unexampled beauty and value, occupying the whole of the space assigned to this division. These Art Treasures, collected by the late Marquis of Hertford, K.G., during a period of 30 years, have hitherto been comparatively unknown to the English public, a large portion of the objects having been specially brought over from Paris within the last three months at the expense of Sir Richard Wallace.

XIV. The basement of the building contains a range of spacious and well-lighted rooms. A portion of this will serve as Refreshment Rooms, and it is proposed to use the remainder for educational purposes, including a Library, and rooms in which classes may receive instruction in the various branches of Science and Art.

XV. It was desired by Her Majesty the Queen that on the 24th June 1872 the Museum should be opened in state by His Royal Highness the Prince of Wales on behalf of Her Majesty, the Prince being accompanied by Her Royal Highness the Princess of Wales.

HENRY COLE,
Director.

The **Bethnal Green Branch** of the **South Kensington Museum** was opened to the public on **Tuesday, the 25th June 1872,** under the following regulations, which are the same as those of the **South Kensington Museum:—Daily** (except **Sundays**). **Free Admission** on **Monday, Tuesday,** and **Saturday,** from 10 a.m. to 10 p.m. On **Wednesday, Thursday,** and **Friday (Students' days), admission Sixpence,** from 10 a.m. to 4, 5, or 6 p.m., according to the season.

Tickets of Admission on Students' days (available both for the Bethnal Green Museum and the South Kensington Museum) are issued at the following rates:—*weekly*, 6*d.*; *monthly*, 1*s.* 6*d.*; *quarterly*, 3*s.*; *half-yearly*, 6*s.*; *yearly*, 10*s.* *Yearly* Tickets are also issued to any school at 1*l.*, which will admit all the pupils of such schools on all Students' days. To be obtained at the Catalogue Sale Stall of each Museum.

A BRIEF GUIDE

TO

THE COLLECTION OF ANIMAL PRODUCTS.

(*July* 1872.)

ORIGIN OF THE COLLECTION.

At the close of the Great Exhibition of 1851, many of the articles there displayed were presented to Her Majesty's Commissioners by various foreign Governments, and numerous individual exhibitors, to form the nucleus of a permanent Trade Collection. It was considered that such a Collection would not only be interesting as constituting a lasting memorial of the Exhibition and a record of the state of industry in 1851, but that it might be rendered of great practical benefit to the manufacturing and mercantile communities if systematically arranged for purposes of reference, with a view both to technical instruction and to the ever-changing and increasing wants of trade in this great commercial country. The Collection thus presented to the Commissioners contained many and valuable specimens in the three great kingdoms of animal, vegetable and mineral products. Great progress has been made in the development of two important National Collections illustrative of the Vegetable and Mineral kingdoms respectively, viz., the Museum of Economic Botany at Kew, and the Museum of Practical Geology in Jermyn Street. No corresponding Collection in the Animal Kingdom has hitherto existed. The Royal Commissioners, therefore, thought it desirable to endeavour to supply this deficiency by the formation of a Collection of Animal Products, the articles in that department, presented to them in 1851, serving as an appropriate nucleus for such a Collection. The Society of Arts, being equally impressed with the importance of this object, co-operated with the Commissioners towards its attainment, and joined in securing the services of Professor Solly for a period of two years, ending in 1855, to superintend the formation of the Collection; Dr. Lyon Playfair, M.P., the then scientific referee of the Department of Science and Art, giving valuable assistance in the development and arrangement of the articles. The Collection was first exhibited to the public in 1857; and in 1858 the whole of the Collection of Animal Products, as it then existed, was presented by Her Majesty's Commissioners for the Exhibition of 1851 to the Science and Art Department of the Committee of Council on Education, forming part of the South Kensington Museum. It is now removed to the Branch Museum of the Department at Bethnal Green, and is arranged in the *Lower Gallery* on the *South Side* of the Museum.

THE general CLASSIFICATION (beginning at the *East* end of the Gallery) adopted in the arrangement of the COLLECTION of ANIMAL PRODUCTS is as follows :—

CLASS I.—ANIMAL SUBSTANCES EMPLOYED FOR TEXTILE MANUFACTURES AND CLOTHING.

DIVISION I. Wool, Alpaca, and Mohair.
„ II. Hair, Bristles, and Whalebone.
„ III. Silk.
„ IV. Furs.
„ V. Feathers, Down, and Quills.
„ VI. Gelatin, Skins, and Leathers.

CLASS II.—ANIMAL SUBSTANCES USED FOR DOMESTIC AND ORNAMENTAL PURPOSES.

DIVISION I. Bone and Ivory.
„ II. Horn and Hoofs.
„ III. Tortoise-shell.
„ IV. Shells and Marine Animal Products for Manufacture, &c.
„ V. Animal Oils and Fats.

CLASS III.—PIGMENTS AND DYES YIELDED BY ANIMALS.

DIVISION I. Cochineal and Kermes.
„ II. Lac and its applications.
„ III. Nut Galls, Gall Dyes, Blood, &c.
„ IV. Sepia, Tyrian Purple, &c.

CLASS IV.—ANIMAL SUBSTANCES USED IN PHARMACY AND IN PERFUMERY.

DIVISION I. Castoreum, Civet, Hyraceum, Musk, and Ambergris.
„ II. Cantharides, Leeches, &c.

CLASS V.—APPLICATION OF WASTE MATTERS.

DIVISION I. Guts and Bladders.
„ II. Albumen, Casein, &c.
„ III. Prussiates of Potash and Chemical Products of Bone, &c.
„ IV. Animal Manures.—Guano, Coprolites, Animal Carcases, Bones, Fish Manures, &c.

The consecutive numbering of the Cases in the order of the Classification is followed as far as practicable, but some departure from this has been unavoidable, as in the divisions of ivory, horns, feathers, &c. Every specimen, or series of specimens, is descriptively labelled, so as to avoid the necessity of reference to a detailed catalogue.

The special object of this Collection is not merely the formation of a Museum showing the various Animal Products entering into British and foreign commerce, but, at the same time, to instruct and inform the visitor as to the magnitude of the trade, the varieties, peculiar characteristics and suitability for various purposes, of different substances. While, therefore, the mere visitor for pleasure will be gratified by a passing glance at such a general collection of useful and ornamental products as has never before been available for inspection, the more thoughtful and inquiring will here find ample opportunities presented to them of studying quietly, systematically and in progressive detail, the principal Arts and Manufactures which result in such individual benefit, and contribute so greatly to our national wealth and extensive commerce.

The various raw materials and products are arranged into classes, groups and subdivisions, which proceed step by step from the raw material, through the various stages of manufacture, up to the finished product. Hence may be learnt the applicability of various substances for special purposes, and the several uses to which different articles are put in an economic and manufacturing point of view

The food products of animals, generally well known, are illustrated in the Food Collection arranged in the opposite gallery.

Descriptive, general, and special labels are spread about the gallery; and every case, article and particular manufacture are so fully described, that the visitor will have little difficulty in gleaning useful information as he proceeds.

As a rule, the visitor should read the general printed label before he proceeds to inspect the specimens displayed in each group.

It will suffice, therefore, in this Guide, to point out the special objects or series to which attention should be given.

WOOL AND HAIR.

The east end of the gallery is devoted chiefly to the woolly or hairy covering of animals in all their variety, and illustrates the economic uses to which these are put, for clothing for the human race, for fabrics of different kinds, carpets, &c.

Stuffed heads of selected animals,* three stuffed sheep from the Shetland Islands, and framed lithographs, show the characteristics of the English breeds of sheep; while in fifty square glass cases are fleeces of Leicester, Southdown, Cotswold, black-faced, improved Leicester, Anglo Merino, Spanish Merino, Portuguese, German, Egyptian, Australian and other principal breeds of sheep. Those directly interested in sheep-farming or in the woollen trade have also here opportunities of investigating the qualities of different wools. Very many varieties of wool, British and foreign, geographically arranged, are placed in bottles on shelves; whilst in the counter cases

* Not at present shown.

the assorted commercial kinds, as used for particular purposes by manufacturers, can be examined. In a glazed wall case is a very fine skin and fleece, of two years' growth, of a Hampshire Down Ram, given by Mr. N. Brown, of Upcott, Swindon; also in a frame made of indigenous woods are samples of raw wool from sheep bred in the colony of the Cape of Good Hope in 1861.

Diagrams and framed samples of wool, with detailed information appended, serve also to point out the number of serratures and curves in particular qualities of wool, its felting properties, the ordinary weight of the fleece, and other particulars.

Having studied the particular characteristics of the different kinds of wool, the visitor may next pass on to its after preparation and notice the difference between those which are carded and those which have been combed, either by machinery or hand.

The process of converting wool into cloth can be followed and studied by an inspection of the Cases **58, 59,** and **60.** Specimens of all kinds of woollen fabrics are shown. The visitor's notice is here directed to a valuable and extensive series of modern foreign woollen manufactures from the following countries, viz.: — Bavaria, Belgium, Egypt, German Empire, Greece, Holland, Hungary, Italy, Morocco, Persia, Portugal, Russia, Saxony, Spain, Switzerland, Tunis, Turkey, and United States,—exhibited at the International Exhibition of 1871, and now lent by Her Majesty's Commissioners. For want of space a portion only of this series is at present exhibited. See Cases **64** to **67.**

In Frames suspended over the glazed cases is a collection of samples of woollen and mixed goods, manufactured and presented by Messrs. Akroyd & Son, of Halifax, Yorkshire.

A feature in this division should not be passed over without notice, and that is the reconversion of waste or previously used wool into inferior cloth under the name of shoddy, which is largely exported to other countries. The waste wool or fragments from carpet or cloth making, old stockings pulled to pieces, &c., are reworked into pilot cloths, druggets and other articles; and a series of bottles containing shoddy, points out the commercial names they bear.

Another use for waste wool is to grind up very fine, and, when dyed of various brilliant colours, it is sifted or powdered over fresh-varnished paper-hangings, to which it adheres, forming the elegant velvet or flock papers imitating figured tapestries and stuffs.

Blankets, flannels, ruggings and mixed fabrics are shown in their various qualities and textures.

Case **52** shows the fleece of wool sorted into the several lengths best suited for different purposes: belly locks; portions of head locks and shank locks; portion twisted to bind up the whole fleece; washed wool; best blanket wool; combing wool, or blanket wool; wool sorted for carpets, druggets, and low quality of blankets.

Case **75** shows the machine blankets and roller cloths used in different manufactures.

A broad distinction is made in wools, which are divided by the trade into long or combing wools, applicable for stuffs and worsted goods, and short or clothing wools for cloth manufacture. The former are, however, again subdivided into wools of from four to seven inches in length, used for hosiery and some other purposes, and those above that length are used principally for coarse worsted goods. Specimens of the spinning processes of worsted yarns are well worth notice, showing that 89,000 yards may be spun to the pound weight, which is a great effort for worsted yarn.

Case **81** contains specimens of the shawls for which the town of Paisley is pre-eminent, which are characterised for their elegance of design, variety of pattern, and skill in manufacture.

Another large manufacture from wool should be studied, that of Carpets. There are samples of all the principal varieties exhibited, and Case **73** shows the stages of the manufacture.

Hair.

From this we are led to the more hairy descriptions of wool—the long, silky, mohair fleeces of the Angora goat, the Alpaca, the Cashmere goat furnishing the celebrated shawl wool, Camels' hair, &c.

Drawings point out the character of the Alpaca, the Vicuna, the Guanaco and other animals of the Llama tribe; while above are placed microscopic diagrams of the texture and formation of different kinds of wool and hair.

Cases **84** to **87** show the raw material, alpaca wool and yarns, and Case **90** mohair and Cashmere goats' hair; while in frames are shown the different fabrics and made from them. In Case **86** are Llama fleeces from animals domesticated at Holly Lodge, Highgate, the seat of the Baroness Burdett-Coutts, who presented them. Alpaca wools, Angora wools, and Camels' hair, from Victoria, S. Australia; and Alpaca raw wools from Peru, are shown in Cases **84** and **85**; whilst in Case **93** is a series of samples of Alpaca and mohair manufactures, manufactured and given by Sir Titus Salt and Sons, of Saltaire, Bradford, Yorkshire.

The next Cases are devoted to an exemplification of the varieties and commercial uses of hair of different kinds; commencing with camels' hair and horse-hair, the raw material

and the several fabrics made of them are shown. See Cases **94, 95,** and **96.**

Horse-hair is used for ropes, sacks, and bags. It is curled for upholstery purposes, drawn for brush-making, dyed of various colours, and made into beautiful damask cloths, chair-seatings, &c. Cow-hair has also its uses for ropes, for stuffing cushions, and for making mortar.

The quills, or stout bristly spines of the porcupine, are another development of hair: they are used as penholders; and eyeletteers and ornamental baskets, &c., made of them are shown.

The hair of the opossum, the wool of the American buffalo, of the musk ox and other kinds of hair, can be seen in this Section, with articles made from them.

Near these is Case **96** containing the leading commercial varieties of hogs' bristles and various brushes used by house painters, artists, writers, &c., made of them or of camels' hair, with badgers' hair, fitch, goats' hair, &c.

Whalebone.

Whalebone is the horny laminæ found in the mouth of the common Greenland or Arctic whale (*Balæna mysticetus*) and of the South Sea or Antarctic black whale (*B. Australis*). These animals have no teeth, but in their place they have substitutes in the form of baleen plates ending in a fringe of bristles. These two extensive rows of whalebone, or "fins," as they are denominated, are suspended from the sides of the crown bone, and hang down on each side of the tongue. Each series, or "side of bone," as the whale fishers term it, consists of upwards of 300 plates or "blades," as they are commercially called. On account of the arched form of the roof of the mouth the longest are near the middle, from whence they gradually diminish away at each extremity. 15 feet is the greatest length of the whalebone, but 10 or 11 feet is the average size, and 13 feet is a magnitude seldom met with. If the largest blade in the series weighs 7 lbs., the whole produce will be about a ton. In young whales, or suckers, the whalebone is only a few inches long; but when the length reaches 6 feet or upwards, the whale is said to be of "size." Whalebone is naturally brownish or bluish-black; but in some animals it is striped longitudinally with white.

The chemical composition of whalebone is albumen, hardened by a small proportion of phosphate of lime.

Its commercial uses are various. It can be dyed of different colours. It is cut into sets of eight for ribs or stretchers for umbrellas and parasols, ranging in length from 21 to 40 inches. It is made into stay-bones for corsets from $\frac{3}{16}$ of an inch to $1\frac{3}{4}$ inch wide, and 12 to 16 inches long. It is shaped into prepared bone for ladies' dresses from 1 to $1\frac{1}{2}$ yard long. It is cut into lengths of "bristle bone," of different sizes and thicknesses, for making brushes, chimney-sweeping, and street-sweeping machines. It is used for covering whip-handles, walking-sticks, and telescopes, rosettes, &c.; and, in the form of shavings, for plaiting like straw in the construction of light hats and bonnets. The waste shavings are employed as a stuffing material by upholsterers, and for filling fire-grates in summer, and all the refuse goes to the farmers for manure.

Three principal kinds of whalebone or fin are recognised in commerce: 1. The Greenland, from the Davis' Strait fishery and various parts of the North Sea; 2. The South Sea, or black-fish whale-fin, brought by the South Sea whalers; and 3. The North-West Coast, or American whale-fin, obtained principally in the Pacific and Behrings' Straits fishery by the United States whalers.

The preparation of whalebone for use is very simple. It is boiled in water for about twelve hours, by which it becomes soft enough to be cut up, while hot, in lengths of different dimensions, according to the use to which it is to be applied; or, by means of a compound guarded knife, is cut into fibres or bristles for brushes of various kinds. In cutting up a blade, the workman examines the appearance of each strip or section, which he sorts according to length and quality as he proceeds.

The surface of the blade is compact, and susceptible of a high polish by mere friction. Its texture is lamellar in the direction of its breadth, so that it easily splits and divides in this direction, but not in that of the thickness of the blade. The middle of the blade is of a looser texture than the rest, and is technically called the grain, being composed of coarse bristly hairs. The general colour of whalebone is a dusky greyish colour, intermixed with thin strips or layers of a paler colour, which are often almost white—very rarely the entire flake is milk-white. Whalebone that has been boiled, and becomes cold again, is harder and of a deeper colour than at first; but the jet black whalebone has been dyed.

Immediately over these are blades or plates of whalebone from the different kinds of whale peculiar to certain seas, showing the whalebone as it comes into commerce, as scraped and cleaned, split or shred into strips, and the several uses to which it is subsequently put. In Case **97** are examples of dyed whalebone, employed for making bonnet plait, artificial flowers, rosettes, &c. is an elegant illustration of the ingenuity which applies such a material to ornamental uses.

In Case **97** of this division may be seen examples of the application of the hair of the

moose-deer to ornamental purposes in the neatly-sewed articles on bark, made by the North American Indians. The devices worked are tasteful. The hair is said to be dyed in the most simple and rude manner of different colours, and hence the colours are fugitive.

Furs.

Following still the investigation of hair, we come in the next division to the large group of skins, for the most part those of wild animals, known in commerce as Furs, which are largely used in many countries for the purpose of warm clothing, ornament and decoration. At present there are but few illustrations of Furs and Skins of animals. But it is intended to furnish this division with sufficient examples, classified into the groups or families recognised by naturalists.

Fur is merely a variety of hair, soft and silky in the colder regions of the globe and, being a bad conductor of heat, well adapted to preserve the warmth of the body. In tropical districts, furs, though often splendid in appearance, have lost their silky quality, and are not fitted for general use.

The fur of most animals is best at the approach of winter. The little weasel of Russia, Sweden, and Norway, which gives the valued ermine, is pure white in winter (except its jet black tail), but in spring and summer it is grey, and of trivial value.

The manufacture of skins into useful and ornamental articles is one of great antiquity and importance. Skins to be worn as an ornamental dress are prepared by the fur-dresser. The furs most esteemed for their beauty and fineness come from northern and Arctic regions. The fur reaches its greatest perfection at the approach of winter, and before the animal has attained great age. The rarer and costlier furs are often imitated by the furrier, by dyeing inferior skins and those of a different species.

The destruction of wild animals by the hunter is enormous in the prairies and wilds of North and South America, the steppes of Russia and Siberia, the jungles of India, and the deserts of Africa. Several ships almost entirely freighted with furs from the Hudson's Bay Company's vast hunting-grounds in Arctic America arrive each season; and an inspection of their stores before their periodical sale is such a sight as is not often to be witnessed.

In cold countries furs and garments of skin are more appreciated than with us, the sheep or lamb skin jacket, the seal-skin garments, the buffalo robes or bear-skins for sledge use or for wrappers, otter caps, mitts, and gauntlets, victorines, cuffs, muffs and boas, become essential articles of dress.

The hunter, when he has captured an animal, strips off the skin and hangs it up to dry in a cool place. When the skins reach the furrier he prepares them in various ways. In this country, the skins being softened, are trampled in close tubs with a little salt butter or grease, which converts the skin into a soft pliable chamois leather. The skins are then scraped with a blunt and then cut with a sharp knife; and the grease is removed by trampling the skins in mahogany sawdust. In other cases, the skin is cleaned, and afterwards tawed with alum, so as to make it into glove-leather. It is now ready for the cutter to be fashioned into the required shapes. In connection with furs may be noticed a native-made South Greenland "Cajak," or canoe, used for seal hunting, with harpoons, &c., lent by M. A. Westenhloz, Consul-General for Denmark. It is placed on the counter.

Fur is often dyed either locally or generally, to remove defects and to imitate furs of superior quality.

Furs have long been used as emblems of rank and were especially referred to in the Sumptuary Laws of Henry VIII. Thus no nobleman was allowed to use the sable unless he had rank above that of a viscount. In the reign of Edward III. the use of the ermine was restricted to the Royal Family, and even now, that fur, under the name of "miniver," denotes the rank of the wearer on state occasions, according to the mode in which it is worn.

The vast territories of the Hudson's Bay Company, forming great hunting-grounds for fur-bearing animals, furnish the largest quantity of furs used in trade. Russia is next in importance, but it has a different race of animals. The fur produce of the United States and of Canada is also considerable.

In Siberia, sables, martens, stoats, foxes, squirrels and ermines, are tracked and trapped by the hunters for their furs. As a general rule, the furs of the eastern are of a better quality than those in the western provinces; but the ermines near the rivers Irtish, Oby, and Ishim form an exception, being of three times the value of those found beyond the river Lena.

In Case **99** are shown native mantles called "Karosses," made of the skins of wild animals, from Bechuan, South Africa. Given by the African Missionary, the Rev. R. Moffat, who presented them to the Collection on the recommendation of Dr. Livingstone, the celebrated African explorer.

Silk.

This division comprises a very large and varied number of samples of the raw material; and as yet an imperfect display of the several finished products made from it.

The visitor should proceed here leisurely, commencing with the *Cabinet* containing examples of silk-producing moths, from various

countries, showing many of the more gaudily-painted large moths, which are known to yield some descriptions of wild silk; but all of which are eclipsed in commercial value by the humble-looking small white moth, the *Bombyx mori*, or common domesticated silk-worm, so largely reared in many countries in order to furnish the raw material for the rich silk tissues with which the world is supplied.

From the moths we are led to the eggs, and processes of rearing the worms and securing the cocoons. Diagrams in this section show the spinnaret of the silk-worm, with the exuded filament of silk; and the spinning tubes of the worm, which at the outlet are united; also magnified filaments of silk, as seen under the microscope.

Silk is the secretion of the worm of the silk-moth (*Bombyx mori*), whose favourite food is the leaf of the mulberry-tree. Silk is secreted from a pair of long tubes ending in a pore of the under lip of the worm. Each thread is made up of two filaments coming from these, and they are glued together by a secretion from a small gland. The quality of the silk depends on the character and difference of the secretions from the two tubes.

The silk-worm begins to spin when it is full grown, choosing some object on which to attach its first thread, which is drawn from one place to the other until the body of the worm is loosely covered by it. Then the worm connects the threads by moving its head and spinning in a zigzag way. The cocoon takes about five days for completion, during which the silk-worm lessens in size; then casts its skin, becomes torpid, and takes the form of the chrysalis.

Great attention having been paid to the breeding of silk-worms, there are several distinct varieties.

The chief object of the silk-breeder is to get cocoons, made of long, strong, fine, even, lustrous and white thread.

The silk-trade of England may perhaps rank next to that of cotton, since silk now forms one of the most important articles of consumption for the purposes of dress, furniture, decoration, and luxury. Silk, it has been well remarked, is both an agreeable and a healthy material. Used in dress, it retains the electricity of our bodies; in the drapery of our rooms and furniture covers it reflects the sunbeams, giving them a greater brilliancy, and it heightens colours with a charming light. It possesses an element of cheerfulness of which the dull surfaces of wool and linen are destitute.

The people of this country pay enormous sums of money for the foreign manufactured silk which they wear, although much is made here. We cannot, however, obtain all the supplies of the raw material our manufacturers require, owing to the competition of other countries, the precariousness of the silk crop, and the increased consumption in Europe, which is now more than threefold what it was at the beginning of the century. The southern countries of Europe still retain the supremacy for the culture and manufacture of silk which they acquired in the sixth century. Grace and beauty owe something to silk. The fluttering ribbon, the rustling and flowing skirts of silk, the silk kerchief loosely knotted round the neck, have materially contributed to make our costume more natural and pleasing to the eye. It is, therefore, satisfactory to see this gay material becoming every day the property of a wider circle of consumers.

Case **106** presents specimens of raw British-grown silks. Case **101** contains a large and varied collection of different cocoons, some being opened to show the chrysalis inside. Case **102** shows cocoons and fine raw yellow silk, contributed by Queen Josephine of Sweden.

In the succeeding Cases are other varieties of silk, as produced in different countries, of a very superior quality; and we may then pass on to **107**, containing beautiful raw silks from China, where the worm is mostly reared and the silk reeled by the peasant population. In Case **110** are samples of raw silk from Japan, given by Lord John Hay; and in Case **104** are cocoons and raw and spun silk from Victoria, S. Australia.

Case **116** contains varieties of the wild and cultivated silk of India, which are interesting. Silk is very generally worn by the higher classes in the East; and a common dark, but very strong, fabric is made of the wild silk of some of the Indian provinces. Case **100** contains a collection illustrating substitutes for the common silk-worm now under trial, with comparative view of cocoons and silk from the common silk-worm and those of the proposed substitutes; and the drawings in frames suspended over these illustrate the diseases to which the common silk-worm is subject. Both prepared by Andrew Murray, Esq., F.L.S.

A curious manufacture belonging to this section should not be overlooked—the preparation of silk-worm gut or cord, which is illustrated further on in the application of waste matters. When the silk-worm caterpillar has left off feeding and is looking out for a convenient corner to spin its cocoon, it is taken and steeped for two or three weeks in pure strong vinegar, and then drawn gently asunder until the gut appears to be of the proper thickness, when it is hung up to dry in the air.

The waste silk, termed in trade "husks and knubs," is used or various purposes. It is

carded and spun for common silk stuffs, and employed for other articles.

In Case **114** may be seen a silk cocoon, distended by the Chinese, and converted into a bag, which is frequently used for conveying state despatches, invitation letters, or other particular documents. The reeling and specimens of spun silk call for no especial remark. Under a glass case is a model of a silk-winding machine for reeling silk. Various frames show the tints given to silk in dyeing. The manufactured silks, satins, velvets, crapes, poplins, &c., will interest ladies from their variety and beauty. The contents of some of the frames are curious, from containing specimens, giving, as it were, the history of silk manufacture and showing the tastes that have prevailed respecting silken fabrics in the last two centuries; many of the samples being patterns of wedding-dresses, made from the years 1695 to 1800. One of them contains a piece of a silk dress worn by the Duchess of Marlborough.

Case **120** should be examined; the magnificent brocaded Chinese silks, with landscapes and figures woven in, showing the skill of this nation, the originators of our silk products and from whom we now receive the greater portion of our supplies of raw silk. The swivel-figured damasks, intended to imitate embroidery, with flossed silks, are interesting from the number of cards employed in the weaving and the large outlay required to set the loom in motion.

The Chinese Crapes, in Case **118**, were presented by Her Majesty the Queen.

The frames with figured silks, poplins, satins, velvets, plain and fancy ribbons, will, of course, attract and interest ladies, who are the best judges of the quality, texture and pattern of these fabrics.

A frame with silk stockings, contains, among others, a pair of such gauze-like fabric as to weigh only two drachms each.

There are some curiosities of manufacture in woven pictures of silk, portraits of Her Majesty the Queen and the late Prince Consort, woven in the loom by M. L. Samuel, of St. Etienne, France; and duplicate copies of a woven picture, representing Neptune's Grotto, built by Frederick the Great at Sans Souci; and manufactured by Messrs. Steiff and Harras, Potsdam. Something of this class is a piece of Welsh linsey, with moral precepts woven thereon in the loom.

Feathers.

Another part of the clothing of animals may now occupy attention in the application of feathers to useful or ornamental purposes by man. The classification of this division is, 1st, into quills and feathers in the arts, &c.; 2ndly, feathers and down for upholstery purposes; 3rdly, feathers for clothing or garments; and, 4thly, feathers for decoration or adornment of the person.

The preliminary descriptive printed label explains in this, as in the other divisions, the structure, composition and peculiarities of feathers. The scientific grouping of birds points out those in each class which supply any feathers or skins for use. Thus, in the Raptores, or birds of prey, we have the osprey, the eagle and the vulture. The Insessores, or perching-birds, the birds of paradise, the paddy or rice bird, the parrots, humming-birds, jays and crows, partridges, snipes, woodcocks, sparrows, &c. The Rasores, or scratchers, include the cock, the peacock, turkey, pheasant and Argus pheasant. The Cursores, or runners, comprise the emu, the rhea and the ostrich, birds which furnish some of the most beautiful and expensive feathers. The order of Grallatores, the waders or stiltbirds, includes, among others, the heron, egret, adjutant, marabout stork, ibis, flamingo and woodcock; and, among the Natatores, or swimming-birds, some useful feathers are obtained from the swan and goose, penguin, duck, eider duck, grebe, loon, darter, cormorant and sooty petrel.

These are some of the chief birds whose feathers possess any commercial value. Stuffed specimens of some of them are shown, and it is intended materially to increase the number.

Our dependence upon the feathered tribe, with the exception of food, for any useful or necessary articles, is but of a limited nature. In some northern countries bird skins form important articles of clothing and are even used for shoes, while the carcases are occasionally burnt for fuel. For a long period the two chief demands on feathers were for quills for writing purposes and as a stuffing for beds. The taste and luxury of later years have, however, drawn more largely upon feathers for the purposes of ornament and dress.

Beside the use of quills (which, however, are largely replaced now by steel pens and other substitutes), we have feathers for personal ornament and decorative purposes, such as the military plumes on the hat of the soldier and the nodding plumes on the carriage for the dead to their last resting-place. Screens, fans and feather brushes of various colours are made in France of ostrich, peacock, cock and other bird feathers for export. In India fans made of peacocks' feathers fetch from 14*s.* to 36*s.* each. Chowries, or large fans made of the peacock's quills split, have sold in Madras at 4*l.* Pelicans' quills and kingfishers' feathers are also dealt in in the East.

Feathers resemble hair, but are more complex in structure. A horny tube, pierced at the end, is first seen; this tube is surmounted

by a stalk from which barbs project; these barbs are fringed with barbules.

"As light as a feather" has passed into a proverb. The largest quill of the golden eagle weighs only 65 grains. The feathers of a common fowl of 2¼ lbs. will weigh only 3 ounces and the entire plumage of an owl weighs only an ounce and a half.

The forms of feathers vary much. In some as in the cassowary, they resemble the spines of the porcupine. In others, as in the eagle and raven, the barbs are stiff and provided with interlaced barbules. In others, as in the ostrich, both barbs and barbules are long, soft, silky and apart. In others, as in the marabout, they resemble a kind of down.

Beautiful articles are made of the skin of the grebe, one of the divers or short winged birds; and very costly and elegant suites from the feathers of the egret, a small bird and so rare and expensive as only to be obtainable by royal wearers.

The fine soft down which lies under the feathers of the ostrich, known in commerce as "estrich," is used in the Cape Colony and in France as a substitute for beaver in the manufacture of hats; and the coarser or stronger sort, called hair, is employed in the fabrication of a stuff or list which resembles fine woollen cloth.

The wing and side feathers of the turkey are useful for trimmings and ornamental articles of dress, and have been made into victorines, boas and muffs.

Another better known article of commerce is the bird of paradise, of which there are several varieties, distinguished by a peculiar union of splendour and elegance; and obtained almost exclusively in the archipelago of islands near New Guinea.

The beautiful wing and tail feathers of the Argus pheasant, which is found only in Sumatra and the Malayan peninsula, are also in request, as well as those of the peacock in China.

Peacock feathers were at one time employed by Canton manufacturers in making variegated threads, which were used in forming beautiful capes for females. Permission to wear the peacock's feather in the cap in China is, like the European orders, always specially granted to the individual wearer.

The elegance of the feathers of the ostrich, arising from their slender stems and the disunited barbs, has occasioned them to be prized in all ages; and they still constitute a valuable article of commerce, and realise a high price for purposes of decoration. Fine white feathers will fetch, even in Graham's Town, seven guineas or more the pound wholesale and coloured 4*l.* or 5*l.*

The Indians and Patagonians make plumes, parasols and many beautiful ornaments of the feathers of the American ostrich or rhea, which are highly valued. In Case **124** is a hammock from Brazil, ornamented with a border of brilliantly-coloured feathers from native birds; given by the Brazilian Commissioner at the International Exhibition of 1862.

There is a magnificently plumed bird found in Central America, the *Trogon viridis*, or *splendens*, which has a graceful form, and its plumage is of a brilliant metallic green, varying to azure, according to the reflected angle of light; beneath is a deep scarlet. The long, slender, gilded feathers of the tail coverts were at one time allowed only to be worn by the family of the Incas.

Marabout feathers are obtained from the Marabout crane in Cochin China and other parts of the East.

Ostrich feathers are much valued for decorative purposes. Those from the back and above the wings of the male bird are preferred, next those of the wings and then those of the tail. They are scoured by soap and water, bleached by sulphur and azured by indigo. The barbs are scraped with glass so as to make them pliant, and the filaments are made to curl by drawing over them the edge of a blunt knife. Many other birds, as the marabout, rhea, osprey, emu, heron, birds of paradise, &c. furnish ornamental feathers. The natural colour of feathers is produced by the internal arrangement of the colourless plates of horny matter and not by any pigment. The artificial colours are given by dyes.

Goose feathers, especially when plucked from the living bird, are much esteemed for stuffing beds; less valuable kinds for this purpose are obtained from ducks, turkeys and fowls.

Quills, or the hollow tubes of feathers, to be used for writing with, are usually taken from geese and are best when plucked from the living bird, or when cast in May or June. In the goose's wing, the five outer feathers are those selected for making pens. The first is hard and round but short; the next two are the best of the five. Quills have a fatty matter on them which would prevent the ink adhering. They are cleansed from this by heating and stripping. The outer membrane is thus removed, while the inner one shrivels up and is seen in the interior of the quill.

The skins of birds are sometimes tanned; thus purses, bags and even shoes are made of them.

Case **122** contains specimens of the varieties of quills used for making pens, in the dressed and undressed state, from the small crow-quill used for fine writing to the large swan-quill used for engrossing. Notwithstanding the common use of steel pens, many millions of foreign quills are imported yearly,

besides what we obtain from our domestic supplies. This Case also illustrates the successive stages of pen-making and the several processes gone through in cutting by the knife or by the machine.

Fishing tackle of varions kinds, including artificial, flies, is exhibited in Case **127**, by Messrs. Chevalier, Bowness and Son, in illustration of the industrial application of feathers, silk, leather, parchment, glue, gut, &c., to such articles.

The bedding feathers call for little notice, although the numerous varieties and special grades of quality are interesting to the dealer and others. Our foreign supplies of feathers for upholstery purposes are large.

The next subdivision brings us to feathers for garments and clothing; and here some interesting novelties will be found in feather tippets, boas, muffs and cuffs, &c., for which various birds are laid under contribution.

To ladies, the ornamental feathers will naturally possess a prominent degree of interest, especially now that the cost has been so greatly enhanced. The ostrich plumes, plain and dyed, the birds of paradise, the fancy plumes for hats and bonnets, the military plumes, the eagle feathers for the Scotch bonnet and feather-flowers for head-dresses, &c., all come under this class.

Under some glass shades are shown a group of flowers, showing taste and ingenuity in dyeing feathers; a bouquet of feather-flowers from Madeira, flowers, insects, &c., made of feathers, and a decoration of feathers in headdress and ornaments worn by the Indians of the interior of Brazil in their native dances; and made chiefly from the bright feathers of the great red macaw.

Quitting feathers, we now come to another class of animal substance, used for domestic, ornamental and other purposes, and have first to speak of

Leather.

Leaving the Silk division, we find ourselves among the prepared skins—those tanned or hardened for strong service and durability. But we first commence with the gelatin, which forms the chief component of skin, as well as the membranes and tendons and parts of the bones of animals. We are here initiated into the preparation of isinglass and gelatin for domestic and general use, have the processes of the manufacture of glue and size placed before us; and notice their economic applications. The manufactured products look widely different from the rough raw materials—bones and hoofs and parings of hides.

Case **128** shows the application of fish-skin as an abrasive material for the workman, and for the more elegant purpose, when dyed and forming shagreen, for covering cases and small boxes.

The next stage of inspection leads the visitor to the manufacture of parchment and vellum, Case **135**, from the skins of the calf and sheep — articles which are specially useful, not only to the lawyer for engrossing deeds, but also for book-binding, drum-heads and for other purposes. A frame contains old specimens of parchment writings, one being nearly six hundred years old.

A preserving product, termed glycerin, enables animal substances, which would otherwise decompose, to be shown here; and thus we have the raw skins of animals exhibited as they have been stripped from the carcase; and this enables the whole process of tanning to be studied leisurely and without the accompanying dirt and stench which are the necessary characteristics of the tan-yard.

In Cases **136** and **137** will be found the principal vegetable substances yielding tanning infusions employed in converting skin into the leather of trade, such as oak and hemlock barks, acorn cups, gambier and such like. In Case **138** are the different tools used in tanning and currying leather.

The first process in the manufacture of leather that may be alluded to is what is termed oiled leather, of which the soft pliable substance known as wash leather, or chamois leather, is an example. The various processes on sheep and other skins can be seen in Cases **139** to **142**; while close by are other oiled leathers, and articles made from them. Another manufacture is white or alumed leather, where great softness is given by a process called "tawing." Case **139** contains skins for making white kid gloves, and shows the successive stages of the manufacture. In the last-named Case is an Italian lambskin; one part in the raw state as imported, another in process of manufacture and another part completely made into leather, out of which is cut a pair of gloves; one being finished so far as it can be without detaching it from the skin.

The visitor may now cast his eyes over the wall space, which he will find covered with tanned hides of different animals; and here by a little study he may soon become initiated into the peculiarities of "butts" and "crops," "bends" and "kips." Almost every kind of skin may be tanned and prepared into leather of greater or less thickness; some skins will tan in a few weeks, others will take five or six years, such as the thick skins of the walrus, the wild boar, the rhinoceros, &c.

Here will be found suspended full tanned hides of the horse, called cordovan leather; ox, cow and buffalo hides, goat, kid and kangaroo skins, the skin of the white whale,

of the seal and even of the python, a large species of boa constrictor.

The skin of the gazelle and large goat-skin bottles used as water-vessels in different countries, are also curious. The thick boar hides, rhinoceros, hippopotamus, and walrus hides, hung at the sides of the counters, should be looked at. Having inspected the rough-tanned and the curried leathers, the visitor may next examine the enamelled leathers; and these can be traced from the skin or pelt, up to the finished product, suited for ladies' patent leather shoes, &c.

Dyed leathers are used for furniture, for coach and shoe purposes, and for bookbinding. Roan and morocco leathers are well exemplified in Case **142,** shown by Messrs. Bevingtons and Sons, containing nineteen varieties of imitation moroccos and "skivers," as prepared sheep-skins are termed.

Suspended from the rail over the cases in this section is a series of photographs of groups of workmen in the employ of Messrs. Bevingtons and Sons, engaged in the various stages of leather manufacture.

The manufactured uses of leather are so various, that it is difficult to say what it is not employed for, although many useful substitutes have been found. Those who are interested in studying the boot and shoe manufacture will find all the stages and processes shown; while boot legs and vamps, fronts and backs, and shoes and boots of all shapes and makes, point out the utility of the substance as a covering for the feet. Cases **138** and **144** contain specimens of the tools used by saddlers, harness-makers, patten and clog-makers and other workers in leather. Among the samples of boots and shoes a pair of heavy cavalry boots of the 17th century form a striking contrast to those of modern times. An inspection of the bookbinding and stamped leathers for wall-hangings will close this class of objects. Case **145** illustrates the application of leather, silk and other animal substances for bookbinding, and the tools and appliances used, as well as the elegance of the finish to which this work can be brought. In Case **140** is an illustration of the application of leather to the manufacture of whip-thongs and other miscellaneous purposes. Suspended in frames are numerous specimens of elegant stamped and embossed, plain, coloured and gilded leathers, for room-hangings and wall-coverings.

This division also includes gelatin, glue, isinglass, parchment and vellum. Examples and illustrations of which may be seen in Cases **128** to **135.**

Ivory.

As this forms a most interesting and ornamental section, it will demand a close and careful inspection in order to appreciate the beauty of the material and the skill and ingenuity displayed in working up the material, and converting it into so wide and varied a range of elegant and useful articles. In this division are shown five magnificent tusks of African male elephants presented to Queen Victoria by the King of Shoa and given to the Museum by Her Majesty; tusks from the male and female Asiatic elephant, lent by J. D. Goldingham, Esq.; also the skull and tusks of an African elephant, exhibited by Messrs. Joseph Gardner and Sons. The stuffed heads with the curved teeth of the male and female walrus will attract notice. After examining the massive and valuable tusks and teeth which adorn the wall, and where longitudinal sections showing the internal structure and texture of ivory may be inspected, the visitor may pass to the manufactured products. It may, however, first be stated that the consumption of elephant ivory is very large, and that the material is expensive. But there are some other descriptions of ivory received, adapted for different purposes, among which are the teeth of the hippopotamus, commonly termed sea-morse teeth (see the skull and tusks of this animal given by W. Childerhouse, Esq.), of the walrus and of the spermaceti whale, and the long, straight, elegant spiral horn of the narwhal, of which some fine specimens are shown.

The teeth proper or grinders of the elephant are coming into use for knife-handles. This material is, however, very different in its construction from ivory.

The Chinese are remarkably skilful in their ivory workmanship, as shown in the delicate lace-work of a Chinese fan, or the elaborate carving of their chess-pieces and draughtsmen.

The teeth of the cachalot, or sperm whale, may be noticed; and a carved cane of ivory, side by side with a turned walking-stick made of the solid side of the bone of a whale—very different, however, in composition and structure, from the material misnamed whalebone in commerce.

The diagrams overhead, being magnified microscopic sections of elephants' tusks, teeth, &c., should not be overlooked, as they will convey a correct idea of the ivory, enamel, dentine and cement which are the characteristic and component parts of these substances.

Horns and Hoofs.

Here there is a wide range for study, and for the acquisition of much interesting and useful information, in examining the great variety of horns which characterise the head of different animals.

In the ornamentally arranged group on the wall will be found collected the horns of some

of the principal animals bearing that frontal appendage.

The visitor should notice the series of skulls, with horns, of the gour, a species of wild ox, from India, some lent by J. D. Goldingham, Esq. and others given by Colonel Foquet; and the horns of the reindeer presented by George Loch, Esq.

Generally, horns consist of a prolongation of the frontal bones which form the axis or core on which the elastic substance is formed. In the giraffe this bony protuberance still keeps covered with the skin; in other cases the skin drops off, as in the deer kind, leaving the bony axis exposed; this annually falls off and is termed an antler. In other cases, as in the ox, sheep, and antelope, the bony axis is never shed, but is covered by an elastic substance cushioned upon the bone by an intermediate vascular body. Beside the two chief varieties of horn, those of the ox and buffalo tribe and the stag, there is another marked variety, which scarcely looks like horn at all, at least what is termed horn in trade, and that is the horn of the rhinoceros, which is a mere appendage of the skin and formed of the hair matted together.

There are two species of this animal; one has two small projecting horns, the other but one and this much larger. They are sometimes nearly two feet in length, and ten inches in diameter, and are used for making tazzas, drinking-cups, whips, sword-hilts, snuff-boxes, and other ornamental articles. When polished, this substance is as veined, transparent, and elegant as tortoiseshell. Horn, it may be here observed, is softened both by boiling water and by heat and can then be pressed, moulded, or cut into plates. Case **168**, on the counter, shows how horn may be chemically bleached, pressed, stamped and worked into fretwork, scarcely differing in appearance from bone or ivory.

Horns are extensively used in the manufacture of knife-handles, the tops of umbrellas, whips and sticks, of spoons, combs, toys, &c. The pith or slough that fills the horn and waste cuttings, are used for manure, for boiling into size, or for making Prussian blue. Having noticed the remarkable difference in character and formation of the horns of the ox, the antelope, the buffalo, the elk, the ram, &c., we are prepared to look into their usefulness in a manufacturing point of view, as illustrated by the contents of the Cases. The fine elk-horns from Germany are getting scarcer every year as the forests decrease.

Another horny substance to be noticed is the hoofs of cattle, which are softened in hot water and pressed and stamped out into horn buttons.

Tortoiseshell.

Another section of this class of substances used for ornamental purposes is tortoiseshell; the horn-like epidermoid plates, or dorsal shields, which cover the bony skeleton of some land and sea shielded reptiles. It is only those of the marine tortoise, however—the hawk's-bill turtle, as it is commonly called—that possess any great trade value. The blades, or plates, have certain peculiar technical names. The five large ones taken from the middle of the shell along the back, and the four large ones on each side, are termed by the workers "the head," while twenty-five smaller plates, forming the rim of the carapace, are called the "feet" and "noses."

The shells or skeleton coverings of various land and sea tortoises may be inspected in the rough state and polished to bring out the shades of colour. The land tortoise shells are too small to be of much commercial value, but they are sometimes used for covering tea-caddies, card-cases, and such like articles.

Bone.

Bone is another material, which, though common, is not, perhaps, considered in its proper light as an important commercial and manufacturing agent. Bone forms the skeleton or framework on which the flesh or soft parts of animals are built on.

It is an important agent in many manufactures, being used by potters, turners, cutlers, glue-makers, sugar-refiners, assayers, and by farmers for manure.

The chemical preparations of bone will also be noticed in the section devoted to the application of waste materials. See also the contents of Case **170.**

Shells, Sponges, and Coral.

The next division of this class is one of the most attractive perhaps of the group, consisting of marine products and substances used chiefly for ornamental purposes. Their great variety, the brilliant play of colours in many of the beautiful articles for adornment of the person which can be formed of them, their association with unfathomed depths and sunny skies in far-off shores of the Pacific or India, all combine to give interest to the subject. Those, however, who collect shells for their beautiful variety as ornaments for the cabinet, for the grotto, or for the mantel-piece, have but a small conception of their importance in a trade point of view. As ornaments they are admired alike by civilised and savages; they also give employment to thousands, whether as divers bringing them up from the bottom of the sea, or as collectors of those which the waves cast up on the shore.

No aggregate account of the commerce in shells is kept, but vessels frequently come freighted entirely with what are termed the mother-of-pearl shells from the Bay of Panama and other localities. Shells are used for inlaying work, for carving into shell-cameos for brooches and bracelets, for cutting into buttons, buckles and other articles of dress attachment, for making ornamental groups of shell-flowers, &c.; and are largely used in India and Western Africa for petty money.

The objects which will attract attention here are—

First the shells from which cameos are cut, which are here exhibited both in ths rough, and in some instances with the shell carved on. A large trade is now carried on in the sale of cameo ornaments. Formerly these gems, worked in relievo, were chiefly cut on stone by Italian artists. Now the largest proportion are carved upon various shells, which furnish two or more distinct layers of different colours, textures and hardness. The shells chiefly used are species of Cassides or helmets, and those which furnish the most decided contrast of dark and light layers of colour are *Cassis madagascerensis* and *C. tuberosa*, which have a white layer upon a dark claret colour. The bull's-mouth, *Cassis rufa*, is a pale salmon colour on orange, as will be perceived in the cameos cut on the shell. The common fountain shell, *Strombus gigas*, which has a yellow layer on pink, is also occasionally used. Shell cameos are now very common, and some display a great deal of taste in the design, cutting and adaptation of the various layers of the shell to the required tints.

Another department of shell work is that of inlaying for papier-maché. The shells principally used for this purpose are the large pearly snail (*Turbo marmoratus*) brought from Singapore, the green snail (*Turbo olearius*) from the African coasts, the pearly white oyster-shell (*Meleagrina margaritifera*) from the eastern seas; and various species of ear-shell, or Haliotis, including the green ear-shell (*Haliotis iris*) from New Zealand; the red ear shell (*H. rufescens*) from California and a smaller and plainer British species (*H. tuberculata*).

These shells are cut into pieces, ground down into a flat surface and polished, and let into the papier-machié and varnished.

The prepared paper, which forms the principal material in the composition, is cut into the required size and shape and made of the consistency of the hardest wood by steeping in oil, after which it is left to dry in an oven. When the required time has elapsed it is removed and left in the open air for some minutes, when a coat of refined black varnish is laid over the surface. Before this varnish becomes dry, pieces of pearl, cut in the form of leaves, roses and other flowers, as the fancy of the artist may dictate or the character of the article may require, are laid on the paper, to which they adhere and which is again placed in the oven. When it has been removed the second time, another coat of varnish is applied on the surface of the pearl and paper indiscriminately. The varnish, when it has had sufficient time to dry, is scraped off the pearl, and the same process is repeated several times until all parts of the surface are made quite even. This gives the pearl the appearance of having been inlaid. The article, which is still in an unfinished state, after a thorough polish, has to be submitted to the hands of an artist, upon whose skill its beauty in a great degree depends. In his hands the piece of pearl, but roughly formed, is soon converted into a full blown flower, surrounded by its leaves and buds. The branches are first traced out by a camel's-hair pencil, dipped in size, upon which gold-leaf is afterwards laid. Then follows the painting of the flowers and leaves, the colours of which are rendered almost indelible by the application of a second coat of refined white varnish. Persons who have seen papier-maché have, no doubt, been struck with the natural appearance given to the leaves and flowers by the pearl, the brilliancy of which endures an incredible length of time.

The process of pearl inlaying, of which specimens are exhibited in Case **153**, is a very simple and effective one. The design required is first pencilled out with shellac varnish. When the varnish is dry, a strong acid is applied to the pearl, which corrodes away all the parts which are not "stopped" by the varnish. The pearl, having been brought into the required form, is placed in its appropriate position upon the surface to be ornamented; and the whole is covered with repeated coatings of varnish until brought to a perfect level. Upon the varnish which adheres to the upper surface of the pearl being removed, the ornament is complete. The pearl is thus inlaid, or rather imbedded, in varnish, by the adhesiveness of which it is secured more firmly than it would be by the old and more tedious process of inlaying. A pleasing circumstance in connection with this manufacture is the desire manifested to produce in papier-maché articles of high merit in point of art; and to discard the more flashy and badly-initated orientalisms with which papier-maché goods have, up to the present time, been almost uniformly disfigured.

The Case **150** illustrating the manufacture of pearl buttons, now in such general use, should be examined, as there can be seen the mother-of-pearl oyster-shell in the rough, with the pieces drilled out to the required size, and subsequently ground down and polished, and the

holes for receiving the thread bored. The great variety of pattern and size, from the lady's tiny button to the Brobdignag button for male attire, can also be seen. This shell cannot be passed over without allusion to the oyster fishery for pearls on the coasts of Ceylon, the Persian Gulf, the Bay of Panama, and other localities. Pearls, as gems for ornaments, are esteemed by all nations, and therefore maintain a high price. In the Case is a good example of the oriental pearl oyster, with a large pearl adhering to the shell. Many fresh-water shells and river mussels yield pearls occasionally; and in Scotland, Germany, and the United States, attention is frequently paid to the search for them. The Chinese, who are exceedingly dexterous and ingenious in all that relates to the manufacturing arts, have discovered a mode of forcing these molluscs to secrete pearl. They open the shell of a large river mussel, and insert small metal or clay figures, which irritating the animal, it covers them with a nacreous deposit, fixing them to the shell, from which they are afterwards detached. These figures generally represent Buddha in the sitting posture in which that image is most frequently portrayed. About 5,000 families are stated to be engaged in this singular branch of industry in two villages alone in the district of Ningpo. Some shells, with these artificially-produced pearl figures, presented by E. A. Bowring, Esq., M.P., should not be overlooked.

The diagrams of pearls in the mussel shell, of nacreous or true pearl, and of prismatic pearl, from drawings by the late Professor Quekett, further illustrate this subject.

Other Cases illustrate the more common and general applications of shells for ornament, &c., as in shell-flowers (see the beautiful examples of ornamental shell-work from the Bahamas in Case **154**), shell articles of different kinds, the cowries used as money, and the larger species formed into snuff-boxes, inkholders, &c., the mussel-shell for holding gold and silver paint, the whelks and some bivalves stuffed for pincushions, the scallops and others employed for domestic purposes; and the transparent window oyster-shell used in China for glazing.

A large trade is carried on in India in a particular shell, of which little is known here, namely, what is termed locally the chank-shell (*Turbinella pyrum*). This solid porcellaneous shell, when cut into segments of circles, forms ornaments for the fore-arms and wrists of native women. They are often painted and gilded and enriched with gems. The chief supply of these shells is from the fishery off Ceylon, where they are dived for in shallow water, and sometimes upwards of four millions are imported in a year into the port of Calcutta. They are cut in a very rude but effective manner by means of a large circular saw, and when shaped into ornaments are termed bangles.

This shell, the trumpet-shell, the conch-shell and some others, are used in different countries as sounding horns, by the Brahmin priests, by herdsmen, by agriculturists and fishermen.

One more object in the shell series demands special notice, and that is in Case **152** a pair of the thin wing shells, the *Pinna nobilis*, famous for the beautiful long silky byssus or filaments which they produce. In Sicily, and some other parts of the Mediterranean, this fibre is fabricated into various articles of wearing apparel, such as stockings, caps, gloves, and waistcoats. The web is of a beautiful yellow-brown, resembling the burnished gold hue which adorns the backs of some splendid flies and beetles. A considerable manufactory is established at Palermo; the fabrics are extremely elegant and vie in appearance with the finest silk. In the year 1754, a pair of stockings made of it were presented to Pope Benedict XV., which, from their extreme fineness, were enclosed in a small box about the size of one for holding snuff. A robe of this material was also presented by a Roman emperor to one of his friends.

Other marine animal products are sponges and corals. The sponge fishery, both in the Mediterranean and the Bahamas, is an important one, occupying profitably a large number of persons, but it requires no detailed notice here. Various specimens of the coarse and fine kinds are shown in Case **154**, used at the toilet or for common purposes; and some will be seen attached to the rock as they grow. In this Case may also be seen two unusually large and fine sponges from the Bahamas and an ancient Greek earthenware vessel with two sponges growing from it.

Two Cases **147** and **148** contain a valuable and most interesting collection of coral, showing the natural growth, and illustrating the application of this substance to ornamental purposes. Bequeathed by the late Alfred Davis, Esq., of Norfolk Square, London.

Animal Oils and Fats.

This, though a less attractive division than the last, is, nevertheless, a very important one in an industrial point of view; and the collection of the various animal oils, whether used in the arts for food or for medicine, is of interest to many. Although the number cannot compete with the wide range of vegetable oils, which now form so important a branch of commerce, yet several are large articles of commerce, such as tallow, whale oil, wax,

&c. and enter into one or two important manufactures, particularly candles and soap.

A study of this division will enable the visitor to comprehend the chemistry of fatty matters, and he will find that fat consists generally of a liquid called olein and two solid substances, stearine and margarine. These ingredients are themselves made up respectively of oleic, stearic and margaric acids, united to a sugar-like substance termed glycerin. Glycerin, which was formerly a waste substance, is now used for many purposes. Its antiseptic properties are shown in the courts of the collection in the preservation of fish, of skins, &c.

The varieties of fats from domestic animals, beef and mutton, tallow and lard, are common, but the sheep's tail oil, horse grease and bone fat, may not be so well known. The clarified suets, lard and marrow, shown by Mr. James Ewen, being divested of the fibrin and aqueous particles, render them better adapted for chemical, culinary, or perfumers' use and lessen their tendency to become rancid.

Bees-wax is an important and useful article, and illustrates one of the numerous useful products for which we are indebted to insects. But as the varieties of the raw material may not prove very interesting, we can pass on to the manufactured products which are sure to attract prominent attention. The groups of wax flowers and fruit not only show the applicability of this plastic material to the purposes of the modeller, but exemplify the taste of the designers and their skill in copying nature.

Wax candles, tapers, &c., are other illustrations of the uses of bees-wax. Before leaving this division, notice should be taken of the illustrations of the soap manufacture and the manufacture of spermaceti candles (Cases **159** and **160**); and this leads us to a consideration of the fish oils, which are numerous, and comprise whale or train oil, porpoise, shark, skate, cod-liver and seal oils and blubber, &c.

The seal oil, for which the carcases of the animals are boiled down after the skin has been taken off, centres almost exclusively at Newfoundland. The whale oil we use is chiefly imported now from the United States, as we have withdrawn, to a great extent, our whalers from the northern fisheries.

Spermaceti is deposited in cold weather by oil from the sperm whale; it is purified by pressure and crystallisation. Its chief use is for candle-making.

Cochineal, Kermes, Lac, and Nutgalls.

We reach now another division, illustrating the pigments and dyes furnished by animals; and here will be found much to study in the insects from which they are derived, in the brilliant colours yielded, and in the descriptive information given respecting their habits, &c.

The insects which thus labour for man's service prove the importance of even small products, for of the dead carcases of the tiny female cochineal insect, which supplies the valuable scarlet and crimson dye, we imported in 1856 about 1,400 tons, valued at fully 700,000*l.*; and as a pound of these insects is composed of about 70,000 insects, at least 202 thousand million must have been slaughtered.

The insect is reared on a species of cactus in Mexico, Algiers, Madeira, and other countries. The harvest is precarious, birds and rain being equally injurious. The collection and preparation are very simple. The insects are usually brushed from the leaves into a basin, plunged for a few minutes into boiling water, and then dried in the sun on a sieve for a day or two. They then look like little wrinkled seeds, of a purplish-grey colour, and in this state they become a valuable article of merchandise. It has quite superseded the old Kermes dye, obtained from an insect of the same family in the south of Europe.

The insects are collected about thrice in the year, off the leaves of the cactus, after it has ripened its fruit, a few only being left for brood; they are killed either by a momentary immersion in boiling water, by drying upon heated plates or in ovens. The last become of an ash-grey colour, constituting the silver cochineal, or *jaspeado*; the second are blackish, called *negro*, and are most esteemed, being probably driest; the first are reddish-brown and reckoned inferior to the other two. The dry cochineal being sifted, the dust, with the imperfect insects and fragments which pass through are sold under the name of *granilla*. Cochineal, according to Dr. Ure, will keep for any number of years in a dry place. Its high price had for a long time induced dyers to look out for cheaper substitutes in dyeing red; and since science has introduced so many improvements in tinctorial processes, both madder and lac have been made to supersede cochineal to a very great extent. Its price, in consequence of this substitution, as well as from more successful modes of cultivation, has fallen very greatly of late years.

The beautiful and expensive pigment carmine is obtained from cochineal.

Specimens of woollen cloths and silk dyed with cochineal and lac, are shown in Cases **162** and **163**; and it may be mentioned that a drachm of the colouring matter of the cochineal will dye a pound of silk, containing, perhaps, 100 miles of thread, and yet the intense colour is imprinted over the whole.

Before cochineal was so extensively produced, the scarlet dye was chiefly obtained

from another insect, the kermes. This insect forms a small round-shaped nest for its eggs, on the leaves of a species of oak in the south of Europe, which are full of colouring matter, and from their berry-like appearance they were long taken for the seeds of the tree, and in olden times termed grains of kermes, or kermes berries. They are chiefly used now in Tunis to dye the red fez skull-caps.

Another important insect product employed in the arts is lac, a substance obtained in several forms in the forests of India. When about to deposit their ova, these insects puncture the young shoots and twigs of various trees. The branches then become encrusted with a reddish coloured resinous concretion, which consists of the inspissated juice of the plant, imbued with a peculiar colouring matter derived from the insect. The insects, when attached to the trees, soon become enveloped in the layer of resinous matter, which hardens on exposure, and this forms the stick-lac of commerce. The insect dies, and the body shrivels into an oval bag, containing a minute drop of red fluid: this is extracted from the lac, and when formed into small cakes, constitutes the lac-dye of trade. Other forms in which lac enters into commerce are seed-lac, thread-lac, shellac, and button-lac, all of which can be seen in the cases illustrating the manufacture of sealing-wax and lacquers, the principal use of lac.

There is one other product formed by insects on trees, which is of considerable utility, and this is what is termed nutgalls, the result of an insect puncture, of which several hundred tons are imported. These are employed in the manufacture of black ink and form the basis of the shades of black in dyeing. The blue galls are the best, containing more tannic acid; but there are very many varieties of galls obtained in different countries, usually of a round form, though some are oblong, ovate, &c. They are all hollow. Sometimes the insect, of which it is the nidus, is found in the gall; but usually it has eaten its way out by a small round hole, which is visible at the side. A fair series of varieties of galls from various countries may be seen in Case **162.**

Microscopic drawings of the gall-fly and the other insects of commercial value are shown.

Coagulated blood is sold in large quantities to calico-printers for dyeing Turkey-red, and to chemical manufacturers for preparing red liquor for printers' use.

Ox-gall, mixed with oil and lampblack and thickened with glue, is said to form the basis of the well-known China pigment termed Indian ink, must of which, of a common kind, is now made at home; but some attribute it to the marine sepia. Formerly some valuable dyes were obtained from molluscs, of which sepia and the ancient Tyrian purple dye are examples; but the abundance of mineral, insect, and vegetable dyes now available renders these valueless at present. Still a notice of them is worth attention.

The colour known as sepia among artists is the produce of one of the Cephalodes. It is a brown liquor contained in the ink-bag of the cuttle-fish, *Sepia officinalis*. It is of a powerful dusky-brown colour and works admirably in water, being used in making drawings in the manner of bistre and Indian ink, but is not applicable with oil.

There is some dispute as to the precise source of the celebrated Tyrian purple dye, so much used for the garments worn by kings and emperors of old. Some authors attribute it to the rock lichens, the orchilla weed of commerce of the present day; but the general and most probable opinion is that it was obtained from some species of Murex and Purpura, the animals of which, when crushed, furnish a rich colour. In the reign of Augustus one pound of wool dyed with this substance sold for about 36*l.* sterling. We need not wonder at this enormous price when the tedious nature of the process is considered, and the small quantity of dye produced by each shellfish. For 50 pounds of wool the ancients used no less than 200 pounds of the liquor of the Murex and 100 pounds of that of the Purpura; being 6 pounds of liquor to one of wool: consequently the rich Tyrian purple vied in value even with gold itself.

Musk, Civet, and Ambergris, as Perfumes.

We are indebted to animals for several healing agents and useful preparations in pharmacy, as well as for some of the most esteemed perfumes.

Most species of animals emit from their skins an odour peculiar to themselves, by which other animals, keen of scent, can recognise and trace them. Some of the secretions of animal bodies, such as that of the polecat and the skunk are offensively disagreeable to the sense of smell, while others are sought after and valued as agreeable perfumes. Among the latter, musk, civet and ambergris are the most important. Many animals have a musky odour, as the musk-ox of Arctic America, the musquash or musk rat, the alligator and especially the musk-deer (*Moschus moschatus*). Several plants and seeds have also a musky odour. The musk of commerce is a substance found secreted in a small bag attached to the under part of the body of a small deer which inhabits some of the far eastern countries. It is one of the most powerful, most penetrating and most lasting of odoriferous substances. It attaches itself and gives a durable scent to everything in its neighbourhood. It is held in high esti-

mation as a medicine among oriental nations; but it is merely a powerful stimulant or antispasmodic, and in large doses a narcotic. The varieties of pod and grain musk, of civet, of ambergris, castor, &c., will be seen in Case **165.**

Another substance known in commerce as civet is secreted by two species of the civet cat belonging to the genus *Viverra*, inhabiting Asia and Africa. Numbers of these animals are kept by the natives in wicker cages for the purpose of collecting the civet they secrete.

Ambergris is a substance, the source of which is not so correctly known, although generally believed to be an excretion from the stomach or intestine of the spermaceti whale. It is a scarce and dear commodity and is used as a perfume and stimulant aromatic, somewhat resembling musk. A handkerchief scented with it retains the odour even after it has been washed. Only a pound or two are occasionally imported.

Castor, or castoreum, is a natural production from the beaver, similar in its origin and properties to musk and civet and, like these substances, has a powerful penetrating odour and a bitter, acrid taste. The odour, however, is fetid and disagreeable and it is only used in medicine. It was once much relied on as an antispasmodic and a stimulant.

Hyraceum is a similar substance obtained from the Cape mountain badger, which has been sometimes used medicinally.

There are several insects which give off animal odours, but little is known as to the chemical nature of the odoriferous substances which they emit; and they are not employed to any extent for purposes of luxury or economy. The *Cerambyx moschatus*, a British beetle, derives its specific name from the musky odour it emits; and a water fly, the *Tipula moschifera*, is used by the inhabitants of Chile to perfume their clothes. Some of the Cerambycides are distinguished by the emission of a fragrant odour, not unlike that of attar of roses, which is so powerful that the insects may be discovered upon trees by passers by, in consequence of the scent diffused through the air, and which is retained for a considerable period after death.

The aroma from flowers obtained by distillation, or when required for pomades, is extracted by fatty bodies, the flowers being strewn over a layer of grease. See Case **165.**

Pharmacy.

Several animal substances are used in medicine. The bony plate of the cuttle fish was formerly used as an antacid, but is now chiefly used for making dentrifices and pounce and as a polishing material.

Another curious substance formerly used medicinally is what are termed "crabs' eyes," a calcareous concretion found in the body of the crayfish.

The cantharides insect, a small gaudy-coloured beetle, is of great use for making a blistering powder. There are several species of this insect; some of a bright green, some of a more dusky brown hue and others of a brown colour, with black bands across the wings. We import them from Sicily and the south of Europe, and some come from China. Swarms of these blistering flies sometimes darken the air in Spain and Sicily. Their disagreeable smell may be perceived before they are seen, and this serves as a guide to those who catch them. That well-known blood-sucker the leech is another medicinal agent imported in millions for the relief of the sick.

Many other animal products, some of which have already been mentioned, come into use in pharmacy, such as isinglass and cod-liver oil, honey, sponge and galls. Isinglass, cod-liver oil, and honey are also exhibited in the Food Collection as alimentary substances.

Waste Materials.

It is one of the most important duties of manufacturing industry to find useful applications for waste materials. Dirt has been happily defined as only "matter in a wrong place;" and the object of this section is to show the useful appliances of the most common objects. On this subject Dr. Lyon Playfair, in one of his lectures, says: "Chemistry, like a prudent housewife, economises every scrap. The horse-shoe nails dropped in the streets during the daily traffic are carefully collected by her and reappear in the form of swords and guns. The clippings of the travelling tinker are mixed with the parings of horses' hoofs from the smithy, or the cast-off woollen garments of the poorest inhabitants of a sister isle and soon afterwards, in the form of dyes of brightest blue, grace the dress of courtly dames. The main ingredient of the ink with which I now write was possibly once part of the broken hoop of an old beer-barrel. The bones of dead animals yield the chief constituent of lucifer-matches. The dregs of port wine, carefully rejected by the port-wine drinker in decanting his favourate beverage, are taken by him in the morning as Seidlitz powders to remove the effects of his debauch. The offal of the streets and the washings of coal-gas, reappear carefully preserved in the lady's smelling-bottle, or are used by her to flavour blanc-manges for her friends. This economy of the chemistry of art is only in imitation of what we observe in the chemistry of nature. Animals live and die: their dead bodies, passing into putridity, escape into the atmo-

sphere, whence plants again mould them into forms of organic life; and these plants, actually consisting of a past generation of ancestors, form our present food."

Gut and Bladder.

The substance termed silkworm-gut, which is, however, merely the macerated worm itself, has been already incidentally noticed.

This manufacture is carried on in Spain, Sicily, and China. The Chines e lines are, however, far superior in length, strength, and finish to those made elsewhere, as will be seen by a comparison with those made at Murcia in Spain, and in Sicily.

The manufacture of goldbeaters-skin (see Case **173**) hitherto almost a sealed process, from the mystery with which it was purposely enveloped, may next be considered; and it will be seen how elegant, durable, and useful a product may be obtained from what would otherwise be but a waste material. The peculiarity of this substance is its durability, for it may be hammered continuously without injury, and hence it is extremely valuable to the gold and silver beater, who is enabled by the use of a heavy iron mallet to hammer out the precious metals to very great thinness.

The goldbeaters' skins are formed from the peritoneal membrane of the lowest gut of animals, shown in spirits in bottles. The membrane, separated from the outer gut, is dried and then put for some minutes into a weak solution of pearl-ash, then scraped, washed and stretched upon a frame. Another membrane, treated in the same manner, is applied upon the former, the surfaces in contact being those which had been previously in contact with the muscular membrane. They at once adhere to each other and form one body. When dried, the double membrane is moistened with a solution of alum and then covered with a coating of isinglass, to which aromatic substances have been added. When the first coating is dried, another wash, consisting of white of eggs, is passed upon it and when dry it is submitted to the action of a strong press, and put into small books for use.

Another preparation from the intestines of animals is that usually termed catgut, though made from the dried, twisted, peritoneal coverings of the intestines of sheep. Catgut cord is used for a variety of purposes where strength and tension are required, as for the strings of musical instruments, for suspending clock-weights, bow-strings, &c.

Case **174** is devoted to the illustration of the manufacture of musical strings. This manufacture requires a great amount of care and skill, both in the choice of materials and in the manufacturing processes, in order to obtain strings combining the two qualities of resistance to a given tension and sonority. Until the beginning of the last century Italy had the entire monopoly of this trade, and they were imported under the names of harplings, catlings, lute-strings, &c.; but the trade is now carried out with more or less success in every part of Europe. However, in the opinion of musicians, Naples still maintains the reputation of making the best small violin strings. The smallest violin strings are formed by the union of three guts of a lamb (not over one year old), spun together.

The chief difficulty in this manufacture is in finding guts having the qualities before mentioned, namely, to resist tension and giving also good vibrating sounds. It is far more easy to arrive at the proper point in the making of harp, double-bass and other musical strings, and the manufacture is not so much circumscribed in the choice of the proper materials.

The tension upon the smallest string of the violin, which is made of only three guts, is nearly double that on the second string, formed by the reunion of six guts of the same size. In the preparation, the sheep's guts, well washed and scoured, are steeped in a weak solution of carbonate of potash, and then scraped by means of a reed cut into the shape of a knife. This operation is repeated twice a day and during three or four days, the guts being every time put into a fresh solution of carbonate of potash, prepared to the proper strength. In order to have good musical strings it is indispensable to avoid putrid fermentation; and as soon as the guts rise to the surface of the water and bubbles of gas begin to be evolved from them, they are immediately spun.

In spinning, the guts are chosen according to their size, and, joined with three or more, according to the volume of the string required, are fastened upon a frame and then alternately put in connection with the spinning-wheel, and submitted to the required torsion. This operation performed, the strings left upon the frame are exposed for some hours to the vapours of sulphur, rubbed with a horse-hair glove, submitted to a new torsion, sulphured again, rubbed and dried.

The dried strings, rolled upon a cylinder and tied, are oiled with fine olive oil, to which one per cent. of laurel oil has been previously added. The oil of laurel is supposed to keep the olive oil from becoming rancid.

The gut strings employed by turners, grinders and for cleaning cotton, &c., are made with the intestines of oxen, horses and other animals. These, cleared by putrefaction of the mucous and peritoneal membranes, and treated by a solution of carbonate of potash, are cut into straps by means of a peculiar knife and spun in the same way as the musical strings.

The uses of bladder and gut for holding

lard, for covering gallipots with preserves, as cases for polonies, &c. and other domestic purposes, are well known.

Insufflated, or inflated guts, are chiefly used for the preservation of alimentary food. These substances have to pass through a long series of modifications and preparations, before becoming articles of use. The end of these preparations is, to free the muscular membrane of the intestine from the two other membranes covering it, the peritoneal and the mucous membranes.

The first operation of scouring, consists in freeing, by means of a knife, the gut from the grease attached to it and also of the greatest part of the peritoneal membrane. The scoured guts are washed and turned inside out, then tied together, put into a vat without any more water than that adhering to them, and left in such a state to undergo a putrid fermentation. The time required for this operation will last from five to eight days in winter and two or three days only in summer. If the fermentation be pushed too far, the guts would be disorganised: to avoid this inconvenience, the workmen are often obliged to add some vinegar, in order to neutralise the ammoniacal compounds formed, and also because fermentation is slow in the presence of acids.

After this fermentation, the mucous membrane is completely decomposed, and also the remaining portions of the peritoneal membrane are easily taken off. The guts are then well washed and insufflated (inflated).

This operation is performed in the same way as swelling a bladder, with this difference, that the extremity of the gut is tied by a ligature serving also to join a new gut insufflated (inflated) in the same way. During this operation, the guts exhale the most noxious smell and workmen employed at such work could not blow many days in succession without having their health affected.

In order to prevent that inconvenient, unhealthy process of manufacture, a Society in Paris proposed a premium for a chemical process enabling the manufacturers of these articles to dispense with putrid fermentation. The process proposed by Mons. Labarraque, the successful candidate, is remarkable for its cheapness and the facility of its application. In following the method recommended by this chemist, these animal matters can be worked more easily, and kept for a longer time without evolving any noxious smell.

The guts, previously scoured, are put into a vat containing, for every 40 guts, 4 gallons of water; to which 1½ pound of (*Eau de Javelle*) oxi-chloride of sodium, marking 13° on the areometer of Baumé, is added. After twelve hours of maceration, the mucous membrane is easily detached and the guts are free from any bad smell; by this method, the process of insufflation or blowing into is more easily performed.

The insufflated guts are suspended in a dry room until the desiccation is complete and, once dried, the extremities by which they were tied together are cut, and in pressing the hand over the length of the insufflated (inflated) gut, the air inside is completely taken out. The guts are then submitted to fumigations by sulphur, in order to bleach and to preserve them from the attacks of insects. After this last operation, the guts are fit for use.

Albumen, the prepared serous matter of blood and the dried white of eggs, enter into commerce for several purposes in the arts and manufactures. It is used in photography and by textile manufacturers for fixing the colours printed on woollen and silk goods.

Prussiates of Potash.

Another large and interesting manufacture, illustrating the utilisation of seemingly waste substances is that of the prussiates of commerce. All kinds of animal refuse, the hoofs of horses, button-makers' refuse, horn shavings, the cuttings of leather, old woollen rags, bone drillings and filings, are melted up with carbonate of potash and scrap-iron to form these beautiful crystals; the animal matters supplying nitrogen to the mixture of which these salts are made. The red prussiate differs from the yellow salt in containing less potassium. The prussiates are much used for preparing Prussian blue, for dyeing woollen and cotton goods.

Specimens of the substances used in the manufacture, of the resulting handsome crystals, and of cloths dyed with Prussian blue, are shown in this section.

Chemical Products of Bone.

The manufacturing applications of bone have been already alluded to; but there are numerous useful chemical products obtained from bone which are deserving of notice, as the description and details of their manufacture do not ordinarily come under public notice. The production of phosphorus, of ammonia, of animal charcoal, and bone-ash, can here be studied, and some of these form large and important branches of manufacture. See Case **170.**

The earthy basis of bones is a mixture of carbonate and phosphate of lime. Bone-ash is applied to many purposes. When ground to a fine powder it is the material of which the cupels, or little cups used for assaying gold and silver, are made. It forms an exceedingly useful polishing-powder for plate and other articles, and is the body from which phosphoric acid is prepared. The ordinary, and

red or amorphous phosphorus obtained from bones are shown. The production of phosphorus, for the manufacture of lucifer-matches, is very large in France and Germany, and we import great quantities of these matches. Red phosphorus is less inflammable and not poisonous; ordinary phosphorus is, however, highly poisonous and produces severe disease in the jawbones of lucifer-match makers. Bone-fat and a gelatin, or size, are obtained in boiling bones. When bones are burnt in a close retort and ground very fine, they produce the animal charcoal known as bone-black. It is used for a variety of purposes, especially for making blacking. It forms the basis of black pigments, and is used for filtering liquors through and in the manufacture of blistered steel.

Caustic ammonia, the sal volatile of the lady's scent-bottle, is another important product obtained from home.

Animal Manures.

In a country like Great Britain, where agriculture forms a main pursuit and where the land at disposal has been so repeatedly cropped, a large available supply of fertilising substances to be added to the soil to restore its producing powers becomes of the highest importance. Hence we find the husbanding of farm-yard manure, the preparation of artificial manures and the importation of extraneous substances from abroad occupy great attention.

Guano, of which samples of the best Peruvian and of some of the commoner kinds imported are shown in bottles, was first brought to England commercially in 1841, but has been used in Peru as a manure for upwards of 600 years. This fertiliser, so rich in ammonia, is now eagerly sought after in most countries; large quantities are used up on the Continent, in the United States and on the sugar-plantations of Mauritius and the West Indies.

Guano has even a manufacting application, for calico is shown dyed crimson with it, the dye being due to a colouring principle termed murixide. Coprolites, which are found in Suffolk and Cambridge, are another valuable source of manure.

Bones have long been esteemed as a valuable addition to the soil. They are employed chiefly in two ways, either as a top-dressing to grass land, or they are drilled in with turnip-seed. Our native supply of bones is not sufficient to meet the increasing demand for them for agricultural purposes, and we therefore import large quantities from Europe, South America, and other quarters.

The dung of many animals is used in the processes of manufacture for its alkaline or other properties; and the dried cakes constitute the fuel of several nations where wood and coal are scarce.

The dead carcasses and offal of animals have also various economic uses. Thus, to say nothing of the dead dogs and cats collected from the sewers, rivers, and dung-heaps by the bone-grubbers, a visit to the knackers' yard (the purchaser of dead horses or the slaughterer of worn-out hacks) would give us much insight into this subject. An examination of the bottles on the shelves in this division of the Collection will be interesting to visitors.

The first operation on a dead horse is to take off the skin, then the flesh to get at the bones. The next point is to divest the bones of adhesive and often putrid flesh. The hair from the skin has a commercial value. The hide goes to the tanner to be made into cordovan leather, or to cover the board-room table of some office or public company. The blood is sold. The flesh is used as food for dogs or for manure. Oil is obtained from the fat of the carcase and from the bones, although not in very large quantities. An ordinary manure is made of the bones and blood, and a better prepared special manure for turnips. The bones are cut into half-inch size, or ground into bone-dust for the use of farmers. The iron shoes and the hoofs also come into the inventory of profit. See diagram, "Value of a dead horse."

The offal from the fisheries, wherever obtainable, forms a very valuable manure for land; and large manufactories have been formed on the coasts of France, Newfoundland and Norfolk specially to prepare it. Attention has frequently been directed to the substances wasted in the fisheries and returned to the sea as garbage, much to the detriment of the fisheries. The difficulty has hitherto been the collection and bringing together the refuse to one or more conveniently situated manufactories.

Substances acting as manures are of three kinds; (1) those which supply one or more wanting ingredients of the plant, as in the case of *sulphate of ammonia* or *superphosphate of lime*; (2) those supplying all, or nearly all, the necessary ingredients, as in the instance of *guano*; and (3) those which enable the soil to be further broken up and its imprisoned ingredients rendered available to vegetation.

Ammoniacal manures, got by acting upon the distillates of animal or some kinds of vegetable matter with sulphuric acid, are highly useful to cereals, when the other ingredients of the plants are presented in sufficient abundance from other sources. They can only be classed under manures of the 1st class. Superphosphate of lime, by itself, is also one of the same ordinary manures; it consists of bones, either of modern or extinct animals, treated with sulphuric acid to liberate a portion of the phosphoric acid, which, uniting with the residual bone-earth, forms a more readily soluble

"superphosphate of lime," mixed with the sulphate of lime or gypsum, formed by the action.

Guanos consist partly of the excrements of sea-birds, but also of the bodies of sea-lions, or other amphibious animals which, collecting in dry climates, such as those of the South American islands, become a valuable article of commerce. The fossil coprolites, the exuviæ and relics of extinct reptiles, represent the guanos in which much of the organic matter has disappeared. Guanos contain much phosphate of lime and ammoniacal salts; in fact, with the exception of silicates present in only small quantities, they contain most of the ingredients of a complete manure.

The third class of manures is not well represented among manures of animal origin, unless woollen refuse and other animal matter, while furnishing ammonia by decay, may also aid in disintegrating the soil by the carbonic acid which they generate.

Many animal substances, such as parts of dead horses and cattle, horns, &c., are converted into manures, either directly or by previously being broken up by treatment with oil of vitriol.

Conclusion.

From the above brief examination of the Collection it will be seen that there are few things in which the public have so great and general an interest, and concerning which they probably possess so little real knowledge, as the trade and commerce in Animal Products applicable to Manufacturing and other purposes; the value and the varied uses to which many of them are turned, the continually changing sources of supply, the quantities consumed, prices, preparation, and so on.

Hitherto there has been no special Collection in this country of Animal Products arranged commercially and explaining popularly and connectedly their useful applications in the several stages and processes of conversion and manufacture. Such a collection can scarcely ever be carried out privately, from the great expense of the ornamental articles, the perishable nature of the materials, and the continual vigilance required to keep them in good condition. The new applications of products, and the increasing demands of trade, render it also a continually enlarging collection.

Besides a large proportion of our sustenance in food, animals furnish us with covering and clothing, in furs and skins, leather, hair, and wool—substances for fuel and light, such as tallow, wax, and spermaceti, train and fish oils, grease from the macerated flesh of horses and other quadrupeds. Materials for writing and bookbinding, in quills, parchment, vellum and leather. For other purposes of trade and miscellaneous uses, bristles, hair, antlers, horns, hoofs, ivory, teeth, bone, whalebone and bladders. For glue, &c., guts, tendons and bones —for strings, guts and silk-gut. Blood for refining sugar, for albumen, for Prussian blue and other colours. Bones and hoofs for bone-black, &c.: fat and marrow for soap and unguents; excrement for manure, for manufacturing uses, for fuel and for sal ammoniac, &c. For dyes and pigments, chiefly insect products; and lastly, for pharmacy and perfumery purposes, cantharides, musk, cod-liver oil, leeches, castoreum, hartshorn, ambergris and other articles.

For the purposes of food, however, man, from his omnivorous character, must always be largely dependent upon the animal tribes, more especially in the temperate climes and colder regions; and for much of his warm and strong clothing no substitute for Animal Products has as yet been found. The survey thus taken will at least serve to furnish an approximate idea of the value and extent of the commerce in Animal Products in a manufacturing and trading point of view.

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Instruction in Science and Art in the Eastern and North-Eastern Districts of the Metropolis, in connexion with the Science and Art Department.

1. Metropolitan District Schools of Art are established at the following places in the Eastern and North-eastern Districts :—

St. Thomas' Charterhouse, Goswell Street Road.
Spitalfields, 12, White Lion Street, Norton Folgate.
North London, Sandringham Road, Kingsland.

These Schools are open in the evening from 7 to 9. There are female classes at each school. Applications for admission, prospectuses, or any other information to be made at the schools in each district.

2. Night classes for instruction in drawing in connexion with the Science and Art Department are held in the following schools :—

Bethnal Green National School.
Hackney Parochial School.
Mile End Church Street School.
Poplar, All Saints' National School.
„ St. Saviour's National School.
Stepney, St. Paul's School.
„ St. Philip's National School.
Whitechapel, St. Paul's National School.

3. Science classes, in various branches of science, also in connexion with the Department have been formed in the following schools :—

Bethnal Green	-	Birkbeck School.
„	-	Abbey Street School.
„	-	National School.
„	-	St. James the Less, National School.
Bow -	-	Baptist Chapel School.
„ (North)	-	Old Ford Road School.
Hackney -	-	Parochial School.
„ -	-	St. Thomas Square School.
Kingsland	-	North London School of Art, Sandringham Road.
Mile End	-	Church Street School.
„ -	-	Church of England Young Men's Society.
Poplar -	-	St. Saviour's National School.
„ -	-	St. Mary's School.
„ -	-	Boys' National School.
„ (Bromley)	-	William Street.
Stepney -	-	Colet Boys' School.
„ -	-	Blue Coat School.
„ -	-	St. Paul's School.
„ -	-	St. Philip's National School.

Information as to fees, &c. can be obtained on application at these schools.

4. The *Science Directory* and *The Art Directory*, price 6*d.* each, published by the Science and Art Department, contain full particulars of the regulations for establishing and conducting Science and Art schools and classes, with lists of those in operation. To be had at the Catalogue Stall.

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The above arrangements are similar to those of the South Kensington Museum.